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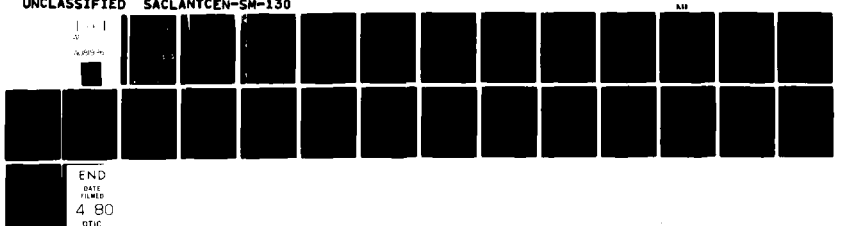

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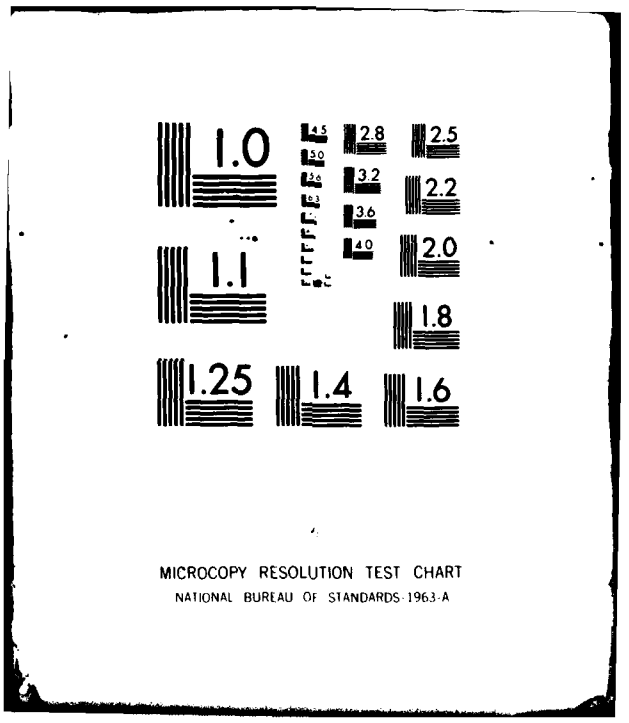
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SACLANT ASW RESEARCH CENTRE MEMORANDUM

INTERACTIVE EDITING OF DIGITAL XBT PROFILE DATA USING A GRAPHIC DISPLAY TERMINAL

by

RICHARD F.J. WINTERBURN and ANGELO LOMBARDI

15 DECEMBER 1979

NORTH ATLANTIC TREATY ORGANIZATION

LA SPEZIA, ITALY

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(9) Memorandum rept.

(6) # INTERACTIVE EDITING OF DIGITAL XBT PROFILE DATA USING A GRAPHIC DISPLAY TERMINAL

by

(10) Richard F.J. Winterburn and Angelo Lombardi

(11) 15 December 1979

(12) 27

This memorandum has been prepared within the SACLANTCEN Underwater Research Division as part of Project 01.

G.C. VETTORI
Division Chief

312450

AB

TABLE OF CONTENTS

List of Figures

INTERACTIVE EDITING OF DIGITAL XBT PROFILE DATA USING A GRAPHIC DISPLAY TERMINAL

by

Richard F.J. Winterburn and Angelo Lombardi

ABSTRACT

A processor is described that, by conversational mode demands, applies full interactive graphical editing to digital expendable-bathythermograph profile data stored within a UNIVAC 1106 computer system.

INTRODUCTION

As part of the total environmental data acquisition system used on board the SACLANTCEN research vessel MARIA PAOLINA G., expendable bathythermograph (XBT) data are acquired on-line using the on-board Hewlett-Packard (H.P.) computer system (1). The data are digitized with a shaft-encoder, and written on magnetic tape for subsequent off-line analysis.

After the transfer of these data from magnetic tape onto the in-house UNIVAC 1106 computer system mass storage (2), a mandatory step prior to any analysis of the data is to edit and clean the raw values of errors induced within the XBT acquisition and digitization systems. Subsequently, the data may be analysed by dedicated software, or transferred into the SACLANTCEN oceanographic data-base system (SMODS) (3) and analysed by the SMODS system suite of application programs.

The edit/compression system described in this memorandum makes full use of the hardware capabilities of the Tektronix graphic terminals connected to the UNIVAC 1106 computer, allowing the user full interactive editing of a displayed image.

1 GENERAL DESCRIPTION OF THE PROCESSOR

The design philosophy of the processor is to allow the user a selection of commands with which to modify a profile or trace. The selection is made from a menu* displayed after a plot is produced of the current status of the profile. This operation can be reiterated as many times as required until a command to stop or store is given.

---

* 'menu' is the generally-used term in interactive graphics to refer to a table of commands displayed on the screen, from which the user is invited to select (4).

The profile is matched to a cruise dictionary file to retrieve additional data of time, position, water depth, etc., and, on completion of the editing, these data are stored individually and also, if required, within the SMODS data base. Figure 1 shows a generalized flow chart of the main elements of the processor.

Chapter 2 of this memorandum describes the modification commands in detail, and Ch. 3 the resultant data store options.

An essential part of this processor is the ability to display the current status of the profile at any time during the editing session; this is described in detail in Ch. 4.

2 MODIFICATION COMMANDS

2.1 General

The processor is designed to be used in an interactive mode using Tektronix graphic terminals equipped with a cursor, i.e. models 4014, 4010 and 4012. However, the processor may equally well be run in batch mode for repetitive or quantity processing if interactive manipulation is not required. In this case the run stream may be set up in the normal way, with the commands assembled as a card deck (see Appendix A).

2.2 Main Menu

At the heart of the edit process is the selection from the main menu. After each command has been executed, and the current status of the profile has been displayed, the menu is again offered until a stop or store command is given. The menu offered is:

NO	to display the full profile
EN	to enlarge a segment of the profile
UP	to delete above a depth
DW	to delete below a depth
IN	to replace a segment
SH	to shift the profile
SS	to edit the sea-surface temperature (SST)
FI	to enter a filter/compression phase
ST	to stop the edit
GO	to store the current profile.

2.3 Function and Use of Each Command

2.3.1 Response of 'NO'

This command yields a plot depicting the current status of the profile; the plot is followed by the menu.

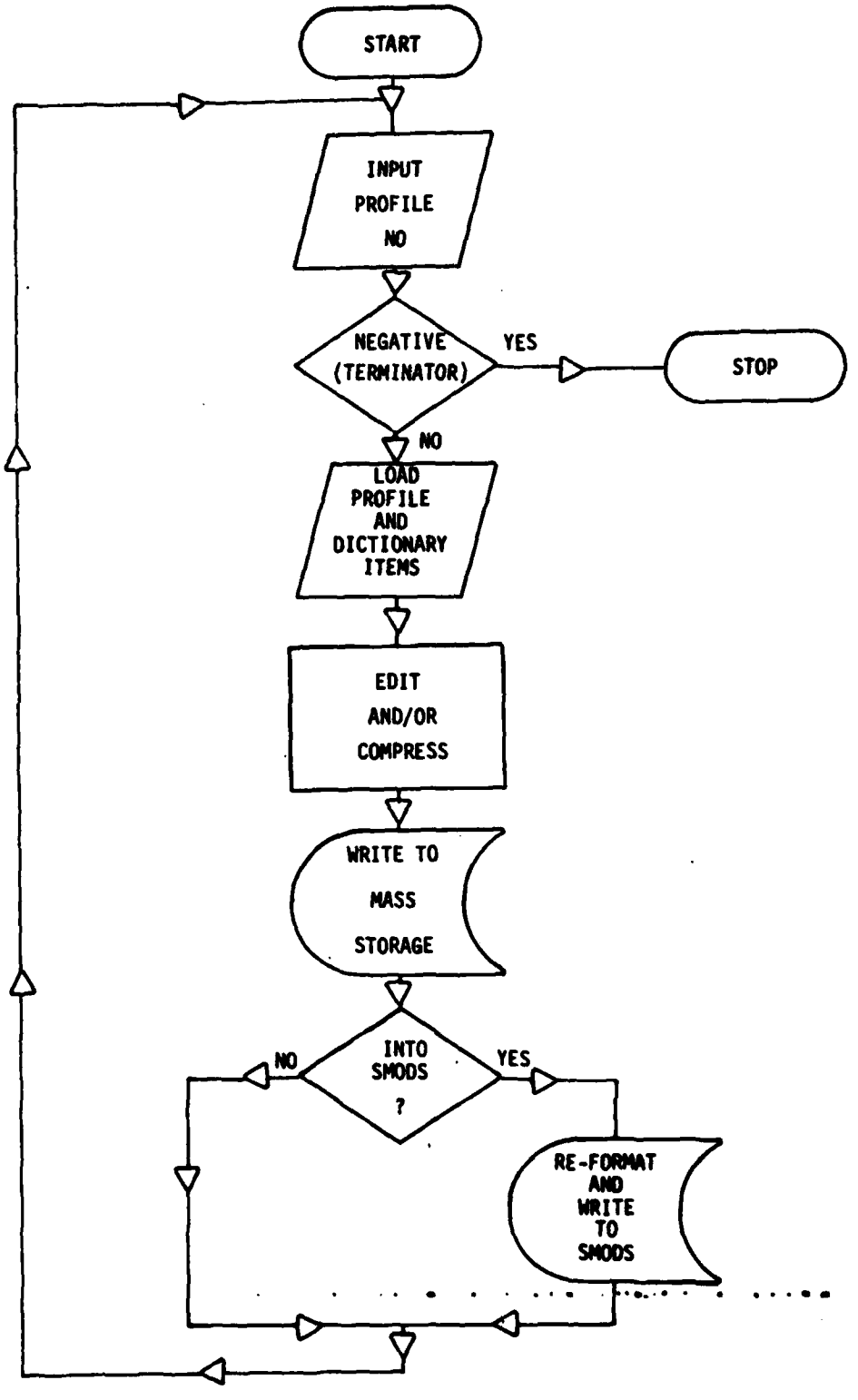


FIG. 1 GENERALIZED PROGRAM FLOW

2.3.2 Response of 'EN'

This activates the interactive cursor to be used to input two depths delineating a segment of the profile to be enlarged by the following requests:

FIX FIRST DEPTH WITH THE CURSOR

After having manipulated the cursor to the required depth and having sent CR/LF (carriage return/line feed)

FIX THE SECOND DEPTH WITH THE CURSOR

This will be followed by a display of the selected segment plotted at an enlarged scale to suit the particular data window.

2.3.3 Response of 'UP'

This command allows the deletion of all profile values with depths less than the nearest depth shallower than a given input depth, solicited by:

FIX THE DEPTH WITH THE CURSOR

2.3.4 Response of 'DW'

This command allows the deletion of all profile values with depths greater than the nearest depth shallower than a given input depth solicited by:

FIX THE DEPTH WITH THE CURSOR

2.3.5 Response of 'IN'

This command allows the replacement of a profile segment by a straight line defined by interactive cursor input of the two depths. The straight-line interpolation is carried out between the two data points that are nearest to and shallower than the two input depths. These are solicited by:

FIX THE FIRST DEPTH WITH THE CURSOR

and

FIX THE SECOND DEPTH WITH THE CURSOR

2.3.6 Response of 'SH'

This allows modification of the entire profile in terms of a shift (positive or negative) in temperature at an input depth, solicited by:

WRITE DEPTH AT WHICH YOU WANT TO CHECK T

The processor then attempts to extract, either directly or by interpolation, the temperature at the required depth. An error message reports if this depth does not fall within the present trace limits. If, however, it is found, the following is output:

AT THIS DEPTH THE TEMPERATURE IS (value)
WRITE THE SHIFT YOU WISH TO APPLY
WHERE OLD TEMP + SHIFT = NEW TEMP

The required temperature difference (positive or negative) is then input numerically.

All the above options (Sects. 2.3.1 to 2.3.6) terminate by displaying the present status of the profile and then returning to the main menu selection.

The next two options (Sects. 2.3.7 and 2.3.8) offer independent sub-menus to the user: one for editing the SST and the other for filtering the profile.

2.3.7 Response of 'SS'

This command allows diverse methods of editing the sea-surface temperature, prompted by the following menu:

PLEASE SELECT FROM:

OK IF ALL OK
EX TO EXTRAPOLATE AUTOMATICALLY
NU TO INSERT NUMERIC DIRECTLY
CU TO INSERT BY CURSOR SELECTION

Selection from this menu is allowed only if the shallowest depth of the trace is less than 20 m. Otherwise the following report is given:

FIRST VALUE AT (depth) METRES
THEREFORE NO SST EDITING ALLOWABLE

(a) Response of 'OK'

This returns control out of the SST edit mode to the main menu, after first displaying the present status of the profile.

(b) Response of 'EX'

At data-acquisition time the on-board computer samples the temperature output at a fixed rate, thus giving an almost fixed depth increment that varies only slightly due to the decreasing drop velocity of the probe. In the near-surface region, therefore, the data may be taken to be equally spaced in depth and if, and only if, no previous editing of this segment of the profile has occurred, then this option may be used. It allows an extrapolation to the sea surface from the nearest measured depth greater than an input depth. The extrapolation is carried out using the mean temperature gradient between that measured depth and a second deeper input depth. The two depths are solicited by:

PLEASE INPUT THE TWO DEPTHS BETWEEN
WHICH TO COMPUTE THE MEAN GRADIENT

From these, given

Zd is the deeper of the two input depths

Zs is the shallower of the two input depths

m the sample number of the first depth greater than Zs

n the sample number of the first depth less than Zd

$(z_i, T_i), (z_{i+1}, T_{i+1})$... successive depth-temperature pairs of the profile

the gradient is defined by

$$\frac{dt}{dz} = \sum_{i=m}^{n} \frac{T_i - T_{i-1}}{z_i - z_{i-1}} (n - m + 1) ,$$

which, for data sampled at equal time intervals that are equivalent to a fixed depth increment, may be simplified to:

$$\frac{dt}{dz} = \frac{T_m - T_n}{Zd - Zs}$$

Using this gradient, the profile is extrapolated from z_m to the surface, and the new segment displayed with a dashed line on a specially-scaled plot of the upper 20 m of the water column (see Fig. 4d).

Control is passed back to the main menu selection. The option is error-limited by the following conditions:

(i) The first depth of the profile must be less than the deeper of the two input depths, i.e. $z_1 < z_n$.

(ii) There must be data at depths between the two input depths, i.e. $z_n \neq z_m$.

Non-compliance with either of these conditions prompts the warning

INSUFFICIENT DATA
NO EXTRAPOLATION ALLOWED
TRY ANOTHER METHOD OR GET OUT

and control is passed back to the SST sub-menu.

(c) Response of 'NU'

This is to allow direct input of a sea-surface temperature value, prompted by

INPUT THE SST VALUE YOU REQUIRE
SAME UNITS AS THE PROFILE

The input value is linked to a depth of zero metres and becomes the first data point on the trace. A dashed line is plotted from this value to the next.

No checks are carried out on the input value, because an error would be immediately apparent on the plot.

Control is returned to the main menu selection.

(d) Response of 'CU'

This command allows interactive input of the required SST value. After a plot of the upper 20 m is displayed, the cursor is activated and its use prompted by

FIX THE REQUIRED SST WITH THE VERTICAL CURSOR

A gross error check is made to ensure that the value lies within the minimum and maximum of the scale of the temperature axis of the plot. If not, the message

ERROR

is given and the request to fix the SST is repeated.

If the value is within the limits, the temperature is computed, attached to the trace as the first point with a depth of zero, and plotted by dashed line to the next point. Control is passed back to the main menu selection.

It is important to note that neither of the latter two options (SS/NU or SS/CU) changes the previous SST value. It merely inserts a temperature at zero depth as the first depth/temperature pair. Thus, if the trace already had a value at zero depth, the resultant trace will have two values at that depth. Conversely, the SS/EX option deletes, amongst other data, the previous SST value, if it existed, and inserts a new one.

The second independent sub-menu is offered by the next main menu selection.

2.3.8 Response of 'FI'

This selects from various filter/compression algorithms, prompted by

PLEASE SELECT FROM:

D1	APPLY TEMPERATURE DIFFERENCE COMPRESSION
WW	APPLY SIGNIFICANT POINT SELECTION
PO	APPLY A SMOOTHING POLYNOMIAL
LT	APPLY A LANCZOS FILTER
IN	INTERPOLATE AT FIXED DEPTH INCREMENTS
ED	RE-ENTER FULL EDIT PHASE

(a) Response 'D1'

This command applies a temperature-difference compression algorithm to reduce the profile to less than a user-defined number of D/T terms, prompted by the following:

BEFORE REDUCTION THIS PROFILE HAD [ ]
DEPTH/TEMPERATURE PAIRS
NOW INPUT THE TEMP. DIFF. INCREMENT TO BE USED
AND THE MAXIMUM ALLOWABLE NO. OF LEVELS

After accepting the first depth/temperature pair, given that

Td = input value of maximum allowable temperature difference between two consecutive values

MAX = maximum allowable number of levels

n = the present level number

NLEV = the number of levels currently retained (initialized at 1)

then for each subsequent D/T pair, the following is computed

$$\Delta T = (T_n - T_{n-1})$$

and if $\Delta T > Td$, the points (D_n, T_n) and (D_{n-1}, T_{n-1}) are retained.

If $\Delta T < Td$ then point (D_n, T_n) is omitted and NLEV decreased by 1. This is carried out over the whole trace; when completed, the value of NLEV is checked.

If NLEV < MAX, then the process is complete and the message

A DIFFERENTIAL CHECK OF (check value) HAS
REDUCED THIS TO A PROFILE OF (NLEV) LEVELS

and control is passed back to the filter menu selector.

If however NLEV > MAX then Td is incremented by the original 1st-difference increment (positive or negative) and the process is reiterated. This iteration is repeated, each time updating the value of Td until NLEV < MAX.

Using a value of $0.055^{o}C$ for Td (this is the approximate temperature equivalent of the digitization increment of the shaft encoder, i.e., the quantization level (1), one iteration effectively inhibits the repetition of the same temperature at successive depths.

The process is shown diagrammatically in Fig. 2, where the temperature scale represents multiples of the digitization level (i.e., $0.055^{o}C$).

The next three options of the filter menu (viz. WW, PO, and LT) have been the subject of a detailed comparative study (5). From this study, optimum values of the control parameters (i.e. weights, extent, etc.) have been chosen and these have been fixed for the option LT (Lanczos filter). For options PO and WW the user is prompted to input his own values. The use of each of these options is as follows:

(b) Response of 'WW'

This allows the application of a compression technique using the gradient change together with a "look-back" technique to control the deviation of the resultant compressed profile from the original. A selection of this option prompts the following:

BEFORE COMPRESSION THE PROFILE HAD [ ] D/T PAIRS
NOW INPUT YOUR MAXIMUM GRADIENT CHANGE AND YOUR
MAXIMA DELTA T AT MID POINT

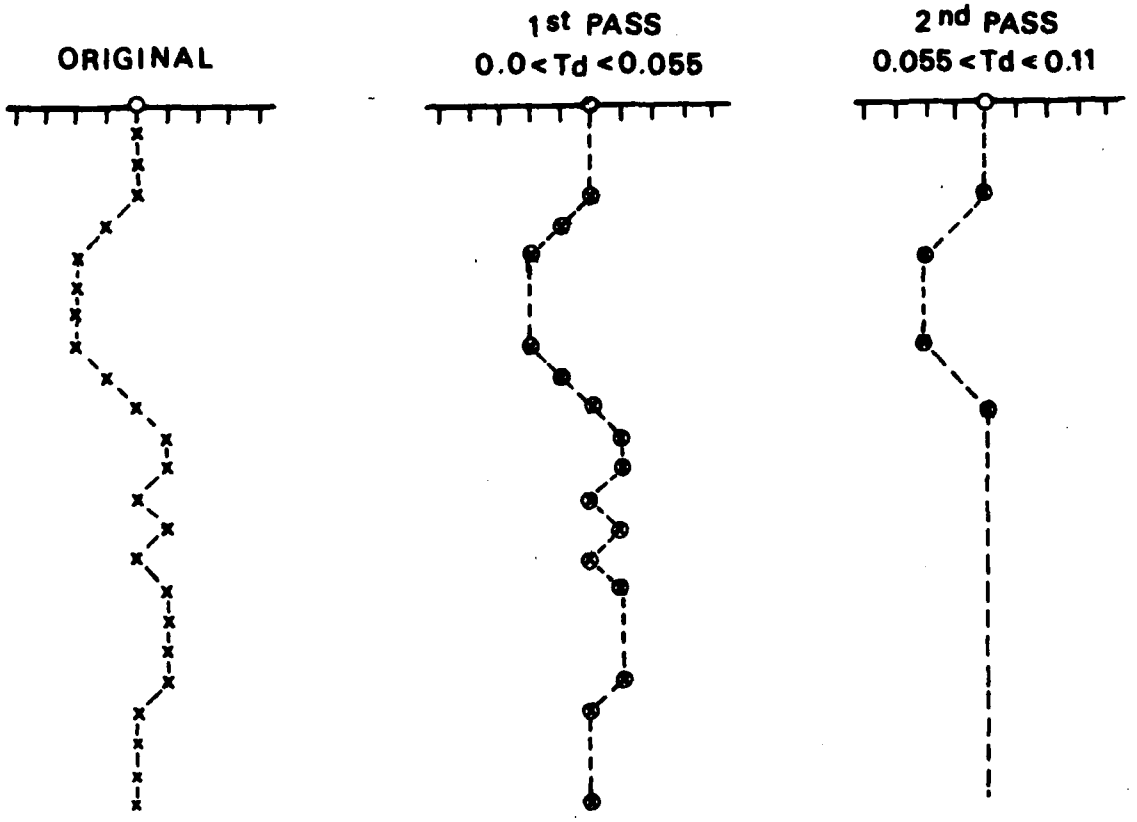


FIG. 2 TEMPERATURE CHECK COMPRESSION

After the algorithm has been applied using the input values, the result is output as follows:

THE PRESENT PROFILE NOW HAS [ ]
DEPTH/TEMP. PAIRS

This current profile is plotted and control is returned to the filter menu selection.

Figure 3 shows how a profile may be progressively compressed by increasing the 'Delta T' value, the number at the bottom of each profile being the number of constituent data points.

The temperature scale is correct for the original profile (519 points). Each subsequent compression is offset by 1^0 on the temperature scale.

(c) Response of 'PO'

This allows the application of a smoothing polynomial on the profile using the UNIVAC 1100 series STAT-PACK library routine MOVAVG (see (6) for a full explanation).

The required control variables are solicited by the following:

INPUT EXTENT OF AVERAGE AND DEGREE OF SMOOTHING
POLYNOMIAL. REMEMBER 2*EXTENT MUST BE > DEGREE

The result of the filtering is output as follows:

THE PRESENT PROFILE NOW HAS [ ] DEPTH/TEMP. PAIRS

This current profile is then displayed and control is passed to the filter menu selection

(d) Response of 'LT'

This command applies a LANCZOS filter (7,8) to the profile. The weights and extent of this filter are fixed, as extensive trials have been carried out (5) to determine the most suitable filter characteristics for these data.

No input data are required, and the result is output as follows:

THE PRESENT PROFILE NOW HAS [ ] DEPTH/TEMP. PAIRS

The current profile is then plotted and control is passed back to the filter menu selection.

(e) Response of 'IN'

This command allows an interpolation of the profile, at an input depth increment, from the surface to the nearest multiple of the increment less than the greatest depth.

The required input data is solicited by:

PLEASE INPUT THE DEPTH INCREMENT AT WHICH
YOU REQUIRE THE INTERPOLATION TO BE MADE

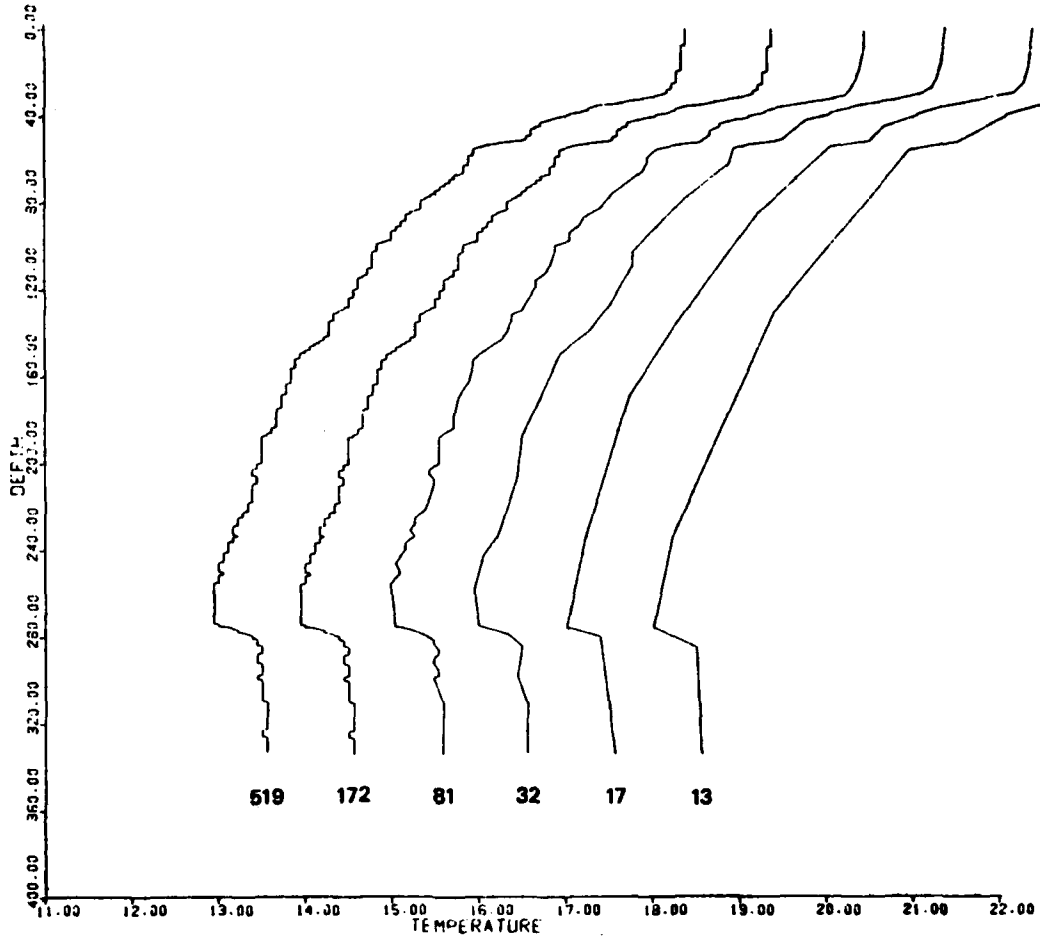


FIG. 3 SIGNIFICANT POINT SELECTION

The response of the interpolation is output as follows:

THE PRESENT PROFILE NOW HAS [ ] DEPTH/TEMP. PAIRS

The profile is then displayed and control passed to the filter menu selection.

(f) Response of 'ED'

This passes control direct to the main menu selection without displaying the profile.

This is the last of the "filter options", the remaining main menu items are termination options.

2.3.9 Response of 'ST'

This command signifies the unsuccessful completion of an editing session and halts all further editing of the profile. The 'currency-status' of the XBT being edited is returned to that in force before the present edit session was initiated, i.e., any edit commands issued between the XBT number selection and this ST command are ignored.

This command is used as an "escape" command to inhibit the updating of a profile by erroneous edit instructions.

2.3.10 Response of 'GO'

This command signifies the successful completion of a particular editing session.

The "current" profile is written into the "results" file (see Sect. 3.1 of this memorandum) and a full report is given of all the editing processes carried out on the profile. If all options have been exercised, the following example would be produced. If, however, as is more usual, only certain of the options had been exercised then only the appropriate reports would be given. This then is the maximum report that could be given:

```
SUMMARY OF THIS EDIT
******* ** **** ****

     BT NO [   ]
POSITION      LAT [   ] N/S
                LONG [   ] E/W
DATE    DAY /  MONTH  /  YEAR
TIME    [   ]
BOTTOM DEPTH [   ] METRES

YOU CARRIED OUT THE FOLLOWING MODIFICATIONS:
DELETED THE UPPER PART FROM [   ] METRES.
DELETED THE LOWER PART FROM [    ] METRES.
DELETED [   ] SEGMENTS.
SHIFTED THE PROFILE [   ] TIMES
  BY AN AGGREGATE OF [   ] DEG.CENT.
```

```
INSERTED A NEW SST VALUE OF [   ] DEG.CENT.
A DIFFERENTIAL COMPRESSION OF [   ] DEG.CENT.
  HAS BEEN APPLIED
A SIGNIFICANT POINT SELECTION HAS BEEN MADE.
A LANCZOS FILTER HAS BEEN APPLIED.
A SMOOTHING POLYNOMIAL
 EXTENT OF [   ] POINTS ON EACH SIDE
 USING A [   ] DEGREE POLYNOMIAL
   HAS BEEN APPLIED.
INTERPOLATED AT [   ] METRE DEPTH INCREMENTS
THE FINAL PROFILE HAD [   ] DEPTH TEMPERATURE PAIRS

THIS TERMINATES THE SUMMARY
**** ********** *** *******
```

Alternatively, if no modifications were applied, then the following message is given:

NO CHANGES WERE MADE TO THIS PROFILE

The processor then exits from the edit phase and enters a storage phase.

3 DATA STORAGE

3.1 Full Profile Storage

As detailed in Ch. 2, the logic of this processor is to input a profile from a data file, modify it and then write or store it in a file. Normally, the second file (a "results" file) would not be the same as the original file; however, there is no restriction on this and the use of the same file name as both input and output has the effect of overwriting (not updating) the previous data.

The modified profile is written in full into a symbolic element as successive pairs of depth/temperature (floating-point) data, terminated by

9999. 9999.

The element has the same name (i.e., the XBT drop number) as had the input element.

No "dictionary" data are attached to the element as these are stored in the associated "cruise positions file". Appendix B summarizes the contents and format of this file.

3.2 SMODS Data Base Storage

In addition to the storage of the full profile in a symbolic element, if the profile has been compressed sufficiently (to < 125 depth/temperature pairs) it may be stored within the SMODS data base.

Due to the quality control requirement this function is carried out only by nominated users.

This storage facility (3) is offered by the following:

DO YOU WANT TO STORE THIS PROFILE IN THE SMODS DATA BASE?

Y OR N PLEASE

If the response is N no further action is taken and control is passed back to the initial entry point of the processor.

If the response is Y, the number of points constituting the present profile is checked. This must not exceed 125, the limit of SMODS data-base storage. If it does so, the following message is output:

THE DATA-BASE IS LIMITED AT 125 D/T PAIRS
AT PRESENT THIS PROFILE HAS [ ] D/T PAIRS
YOU ARE THEREFORE ADVISED TO SHORTEN OR
COMPACT THIS PROFILE IF YOU WANT SMODS STORAGE

Control is then passed back to the main menu selection.

If the maximum number is not exceeded, then the following request is made:

AUTOMATIC DATA-BASE PLACEMENT?

Y OR N PLEASE

Storage within SMODS may be achieved in one of two ways, viz. automatically (dynamic key creation) or manually (user specified keys).

The information necessary for SMODS storage is a string of five parameters:

Instrument Code
Marsden Square (MSQ)
1 degree square (DSQ)
Month
Consecutive Number

The first four of these are either taken directly from the dictionary file or computed (MSQ and DSQ may be computed from latitude and longitude). However, the fifth key "Consecutive No", is the lowest level of a five-level, inverted-tree, hierarchical structure. That is, it is unique within any one owner-member chain, through each of the four higher levels. The store option of this processor allows this consecutive number to be defined in two ways, i.e., dynamically or specifically. The former is done by the processor itself to locate the next available consecutive number that is free to be used as a data-base key. The profile is then stored using that five-parameter key identity. The latter allows the user to specify the consecutive number. In this way the former is used to load new data and the latter to overwrite existing data. If automatic placement is not required, the following is requested:

INPUT THE CONSECUTIVE NUMBER OF THE ELEMENT
IN WHICH YOU WISH THIS XBT TO BE STORED

The processor then attempts to carry out the loading of the profile and associated dictionary data into the data base. Any error is detected through the data management system (see (9)) and reported via:

```
THE BT WILL BE LOADED INTO FILE/ELEMENT [   ]
BUT GIVES IFLAG = RETURN ERROR STATUS
THEREFORE THIS XBT WILL BE OMITTED
```

Non-error detection is reported by:

```
THE XBT WILL BE LOADED INTO FILE/ELEMENT [   ]
** COMPLETED SUCCESSFULLY **
```

Control is then passed back to the initial entry point of the processor.

4 CURRENT-STATUS DISPLAY

This is a "live" plot in that it provides an up-to-date status report on the profile under correction.

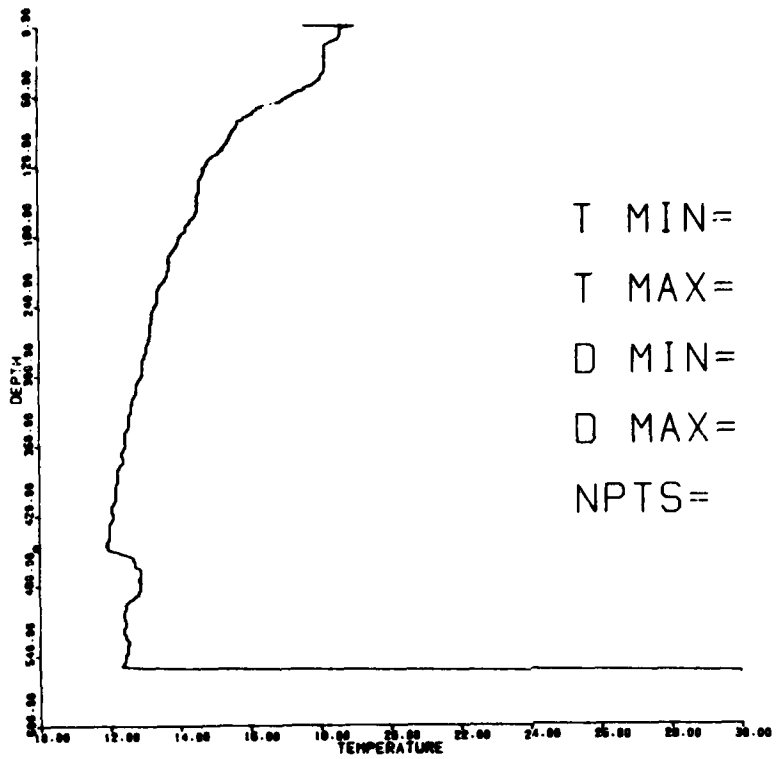
The axes are self-scaled to fit the particular "data window" to be shown: the temperature scale in multiples of ten degrees centigrade, and the depth scale in multiples of hundreds of metres. The annotations are constantly updated to the particular plot characteristics and are separated into two clear descriptions, viz. that of the display (PLOT), and that of the profile (TRACE) displayed or not. If an enlargement of part of a profile is displayed (see Fig. 4c) then the TRACE limits are the limits of the segment of the profile actually being displayed. In this way, in Tektronix terminology (10) PLOT is analogous to SCREEN graphics and TRACE to VIRTUAL graphics.

However, NPTS values refer to the number of points on the display (i.e., visible) and on the trace (i.e., displayed or not, the total number of points at present comprising the profile).

As an example of the changing of the profile "currency-status", Figs. 4a to 4f show the plot output stages of an edit session.

Figure 4a shows a profile at the initial stage with clear errors both at the bottom and the surface. Figure 4b is the current status after the error at the bottom has been removed by the DW option. Figure 4c is the current status after the EN option has been applied. It is clear that the number of points on the plot is only 174 and that the trace is untouched at 875 (as shown on Fig. 4b). Figure 4d is the enlarged plot produced by the SS option. In this case the SST error is to be corrected to that of the dashed line. This plot is produced before the update takes place, i.e., NPTS (TRACE) is still 875. However, after this option is completed the full profile is displayed (Fig. 4e) before offering the edit menu for a further selection. As is clear, NPTS is now 869 for both plot and trace. Figure 4f shows the current status after the profile has been compressed to only 13 points.

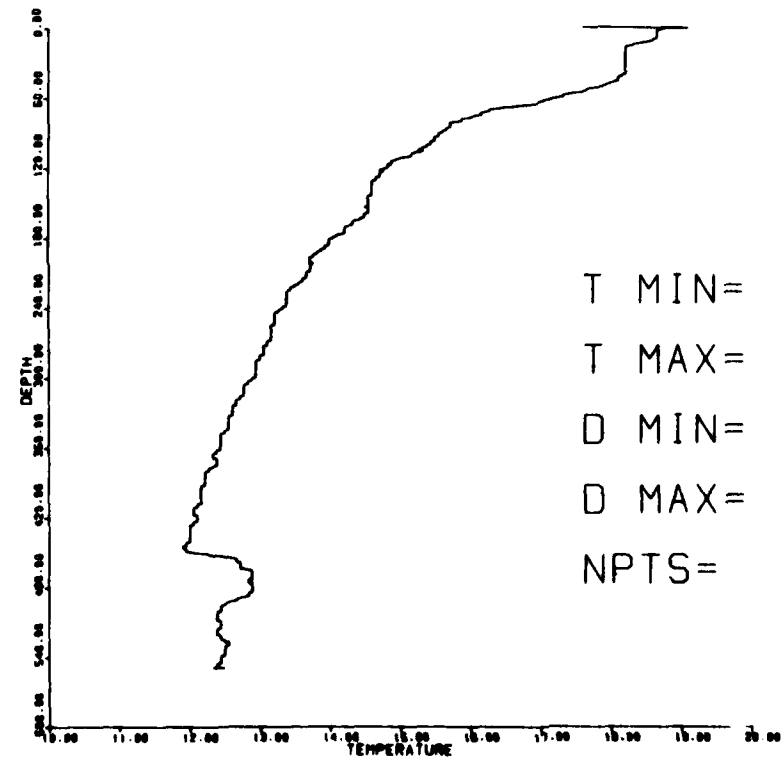
Thus, at every stage during the edit/compression interactive process, the user is given a visual description of the present profile status to enable him to continue with any further editing.



XBT NO 48

	PLOT	TRACE
T MIN=	10.0	11.89
T MAX=	30.0	35.50
D MIN=	0.0	0.0
D MAX=	600.0	555.8
NPTS=	886	886

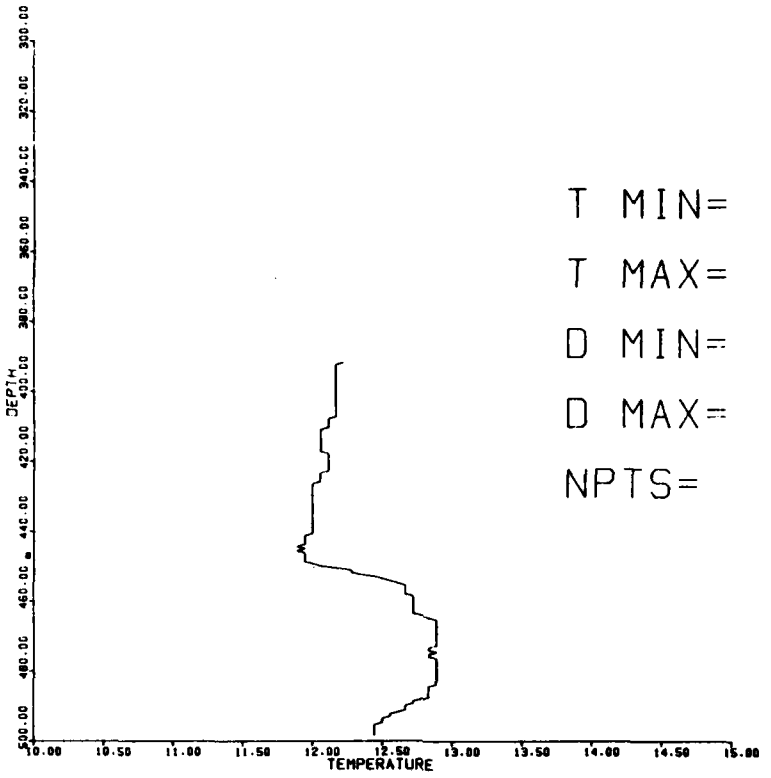
FIG. 4a CURRENT STATUS PLOT
(a) Original data



XBT NO 48

	PLOT	TRACE
T MIN=	10.0	11.89
T MAX=	20.0	19.11
D MIN=	0.0	0.0
D MAX=	600.0	549.1
NPTS=	875	875

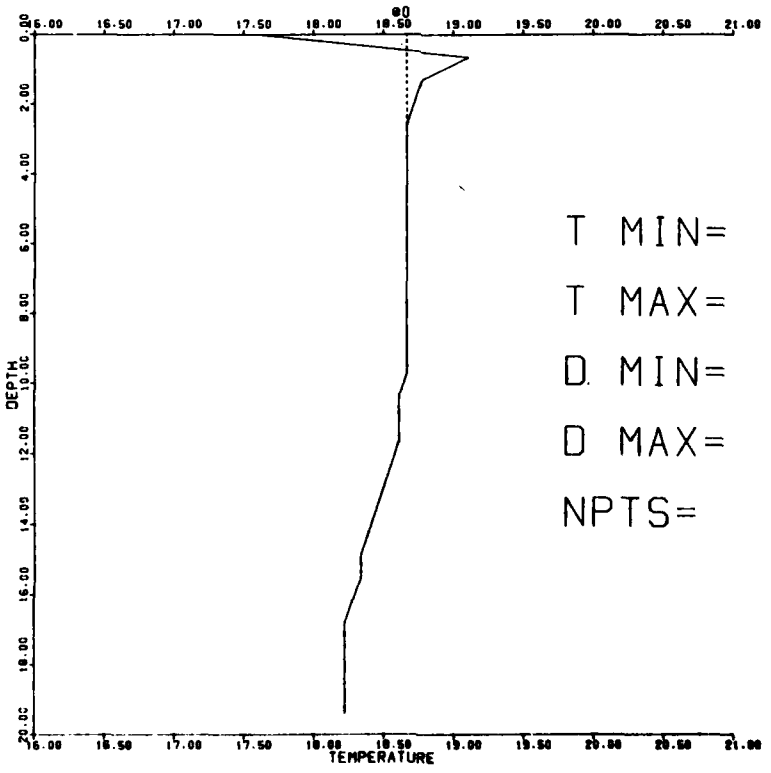
FIG. 4b CURRENT STATUS PLOT
(b) After DN option



XBT NO 48

	PLOT	TRACE
T MIN=	10.0	11.89
T MAX=	15.0	12.89
D MIN=	300.0	391.7
D MAX=	500.0	498.4
NPTS=	174	875

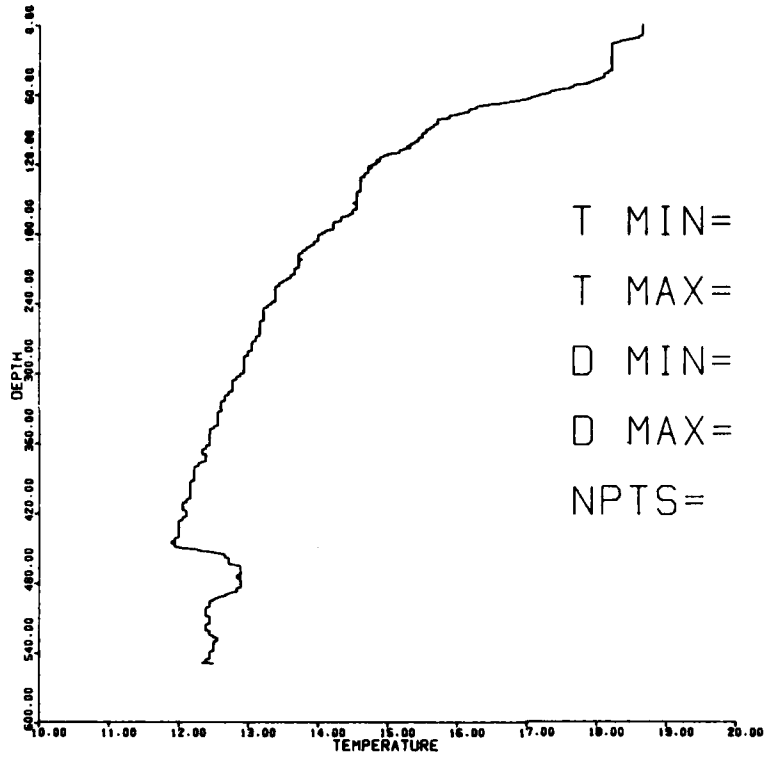
FIG. 4c CURRENT STATUS PLOT
(c) After EN option



XBT NO 48

	PLOT	TRACE
T MIN=	16.0	17.61
T MAX=	21.0	19.11
D MIN=	0.0	0.0
D MAX=	20.0	19.4
NPTS=	31	875

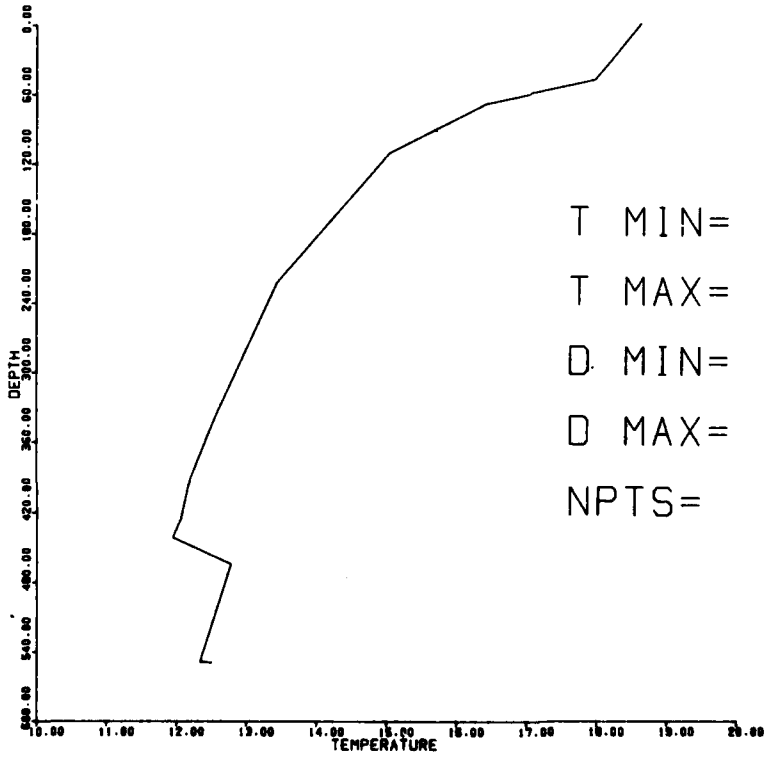
FIG. 4d CURRENT STATUS PLOT
(d) During SS option



XBT NO 48

	PLOT	TRACE
T MIN=	10.0	11.89
T MAX=	20.0	18.67
D MIN=	0.0	0.0
D MAX=	600.0	549.1
NPTS=	869	869

FIG. 4e CURRENT STATUS PLOT
(e) After SS option



XBT NO 48

	PLOT	TRACE
T MIN=	10.0	11.94
T MAX=	20.0	18.67
D MIN=	0.0	0.0
D MAX=	600.0	549.1
NPTS=	13	13

FIG. 4f CURRENT STATUS PLOT
(f) After FI option

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APPENDICES

APPENDIX A

ACCESS TO THE PROCESSOR

The processor is stored within the SMODS*SYSTEM complex and is activated by

```
@ XQT   SMODS*SYSTEM.XBTEDIT
```

However, certain prerequisite file assignments must be made as follows:

```
@ ASG,A   File containing the data to be edited
@ ASG,A   File in which to write the edited data
@ ASG,A   File containing the dictionary information
@ ASG,T    A temporary work file large enough to hold
           all the XBTs to be edited in the session.
```

All files are accessed internally by the unit numbers, attached externally to their corresponding file names, with the EXEC8 control instruction @ USE, as shown in the example runstream given below:

BATCH RUN STREAM – EXAMPLE

```
@ RUN  RW,310Z01,SMODS          STANDARD EXEC 8
@ ASG,A   SMODS*SYSTEM          THE PROGRAM FILE
@ ASG,T   11,///500             A TEMPORARY WORK FILE OF 500 TRACKS
@ ASG,T   22,///500             A TEMPORARY RESULTS FILE
@ USE  21,FILE1                 THE ORIGINAL PROFILE DATA
@ USE  23,FILE2                 THE POSITIONS FILE
@ ASG,A   21
@ ASG,A   23
@ XQT  SMODS*SYSTEM.XBTEDIT
2                               PROFILE NUMBER
@ ADD,E   21.2                  THE PROFILE DATA
SH                              SHIFT OPTION
0.1                             SHIFT BY 0.1 DEG. CENT.
FI                              FILTER OPTION
WW                              APPLY THE INFLEXION POINT SELECTION
0.2,0.035                       USING D2DIV = 0.2,DELTAT = 0.035
ED                              RETURN TO MAIN EDIT MENU
SS                              SEA SURFACE TEMPERATURE OPTION
IN                              INSERT DIRECTLY
17.15                           INSERT SST OF 17.15 DEG.CENT.
OK                              ALL EDITING FINISHED*START DATA STORAGE
Y                               YES, STORE IN SMODS DATA BASE
N                               NO, NOT AUTOMATIC DATA BASE KEY
27                              LOAD INTO ELEMENT 27 OF DEFINED FILE
-1                              ALL FINISHED
```

APPENDIX B

The dictionary file, compiled independently, should contain the following 'free-field', mixed type data, for each BT being edited:

PARAMETER	TYPE (I=integer) (F=real)	COMMENTS
BT No.	I	To be matched to word 9 of the on-line recorded dictionary.
LATITUDE	I,F	degs., minutes south negative.
LONGITUDE	I,F	degs., minutes west negative.
SEA SURFACE TEMP.	F	^{o}C from cappello, bucket, or intake
WATER DEPTH	I	metres
TIME	I	24 h. GMT e.g. 1335
DAY	I	1 to 31
MONTH	I	1 to 12
YEAR	I	year - 1900, e.g. 78

* The cappello is an in-house designed, towed fast response thermistor, normally measuring the water temperature at about 8 cm below the free surface.